

What is claimed is:

1. A plasma processing method for monitoring an operating status of a plasma processing apparatus and/or a processing status of an object being processed, based on a result of analyzing light emitted from a plasma generated while the plasma processing apparatus performs a plasma process on the object in a processing chamber, the plasma processing method comprising the steps of:

obtaining an emission spectrum emitted from the plasma as optical data when the plasma process is performed on the object;

obtaining quantitative data of each emission source from the obtained optical data by using reference data in a database storing therein emission spectra of a plurality of emission sources as the reference data; and

estimating the operating status of the plasma processing apparatus and/or the processing status of the object being processed, based on changes in the quantitative data of said each emission source.

2. The plasma processing method of claim 1, wherein the database is created in advance by the following steps of: obtaining as optical data an emission spectrum emitted from a plasma during a plasma process performed under a plurality of process conditions; and separating the optical data into

the emission spectra of the plurality of emission sources by a multivariate analysis and storing the separated emission spectra thereof as reference data.

5 3. The plasma processing method of claim 2, wherein the multivariate analysis is an independent component analysis, and the emission spectra of the emission sources correspond to independent components obtained by the independent component analysis.

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4. The plasma processing method of claim 3, wherein the number of the independent components obtained by the independent component analysis is greater than or equal to the number of process gas species used in the plasma process.

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5. The plasma processing method of claim 1, wherein the database is created by a separate database creating unit other than a plasma processing apparatus for performing an actual plasma process.

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6. The plasma processing method of claim 1, wherein the step for obtaining the quantitative data of said each emission source includes determining inner product values between the optical data of the emission spectrum obtained by the plasma process and the reference data of each of the
25 emission sources stored in the database, and setting the

inner product values as quantitative data of each of the emission source.

7. The plasma processing method of claim 1, wherein the
5 step for estimating the operating status of the plasma
processing apparatus includes estimating that the operating
status of the plasma processing apparatus is stable when the
quantitative data of said each emission source become stable
after the plasma processing apparatus performs the plasma
10 process.

8. The plasma processing method of claim 1, wherein the
step for estimating the processing status of the object
being processed includes estimating a completion of the
15 plasma process for the object based on changes in the
quantitative data of said each emission source.

9. A plasma processing apparatus for monitoring an
operating status of a plasma processing apparatus and/or a
20 processing status of an object being processed, based on a
result of analyzing light emitted from a plasma generated
while the plasma processing apparatus performs a plasma
process on the object in a processing chamber, the plasma
processing apparatus comprising:

25 a unit for obtaining an emission spectrum emitted from
the plasma as optical data when the plasma process is

performed on the object;

a unit for obtaining quantitative data of each emission source from the obtained optical data by using reference data in a database storing therein emission spectra of a plurality of emission sources as the reference data; and

a unit for estimating the operating status of the plasma processing apparatus and/or the processing status of the object being processed, based on changes in the quantitative data of said each emission source.

10. The plasma processing apparatus of claim 9, wherein the database is created in advance by the following steps of: obtaining as optical data an emission spectrum emitted from a plasma during a plasma process performed under a plurality of process conditions; and separating the optical data into the emission spectra of the plurality of emission sources by a multivariate analysis and storing the separated emission spectra thereof as reference data.

11. The plasma processing apparatus of claim 10, wherein the multivariate analysis is an independent component analysis, and the emission spectra of the emission sources correspond to independent components obtained by the independent component analysis.

12. The plasma processing apparatus of claim 11, wherein the number of the independent components obtained by the independent component analysis is greater than or equal to the number of process gas species used in the plasma process.

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13. The plasma processing apparatus of claim 9, wherein the database is created by a separate database creating unit other than a plasma processing apparatus for performing an actual plasma process.

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14. The plasma processing apparatus of claim 9, wherein the unit for obtaining the quantitative data of said each emission sources determines inner product values between the optical data of the emission spectrum obtained by the plasma process and the reference data of each of the emission sources stored in the database, and sets the inner product values as quantitative data of each of the emission sources.

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15. The plasma processing apparatus of claim 9, wherein the unit for estimating the operating status of the plasma processing apparatus estimates that the operating status of the plasma processing apparatus is stable when the quantitative data of said each emission source become stable after the plasma processing apparatus begins to perform the plasma process.

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16. The plasma processing apparatus of claim 9, wherein
the unit for estimating the processing status of the object
being processed estimates a completion of the plasma process
for the object based on changes in the quantitative data of
5 said each emission source.